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LACIE PHASE III ANALYST FIELD TRIP PLAN

National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

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LACIE PHASE III ANALYST
FIELD TRIP PLAN

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1. INTRODUCTION

During the Large Area Crop Inventory Experiment (LACIE) Phase II, a significant contribution to the CAMS Analyst Training Program was interpretive feedback provided through analyst field trips. They offered the opportunity to observe, first hand, many factors affecting the variability of spectral signatures on Landsat imagery. This experience enhanced the interpretive knowledge and confidence of analysts by providing a correlation between conditions on the ground and those in the image scene; thus satisfying the objectives of the LACIE Phase II Field Trip Plan (LEC-8639).

This document, prompted by the success of the Phase II field trips, presents a plan for continuing the field trip program for LACIE Phase III. It includes a summary of field trip results to date and proposes revisiting the "Learning Sites" during Phase III. These revisits will provide the same benefits as derived during Phase II, illustrate year to year variability, and continue to build learning site files for use in new analyst training. In additional, several Intensive Test Sites (ITS) are recommended for visitation.

"Typical" wheat growing regions do not illustrate the unusual interpretation situations that present analytical problems. Those regions which exhibit unfamiliar crop types, atypical field patterns (dictated by terrain, cultural practices, etc.), cropping practices (e.g., rotation schemes, row width, irrigation, etc.), and wheat grazing detract signifi-

cantly from the quality of an interpretation and are therefore prime choices for ground observations. Therefore, the additional sites are selected from the available Intensive Test Sites based upon their variability and the presence of interpretation problems.

An additional aspect of the Phase III plan is local trips to northern Harris County, Texas. These trips will provide analysts (in an extremely cost effective manner) with the opportunity to observe wheat and other small grains in the field and talk with farmers and local agricultural representatives.

Excluding the local trips, the scope of this plan includes at least one trip for each CAMS operational analyst and periodic participation by supervision (approximately 60 personnel). The information derived from the trips will be disseminated to all analysts through lecture presentations and active "learning site" files.

Trip schedules are detailed in Appendix A.

2. SUMMARY OF LACIE PHASE II FIELD TRIPS

The Phase II field trip program included three visits during the wheat growing season to three "learning sites" located in Williams County, North Dakota, Hand County, South Dakota and Finney County, Kansas. A total of eighteen (18) analysts participated in the program. Coordination and assistance was accomplished through the ASCS County Executive Director at each site. Ground photography was taken of.selected fields within the site, the same fields for each of the three visits. Pertinent facts learned from field personnel were also recorded. The photographic and written documentation were included in "learning site" files and used in presentations to all analysts.

The following observations are a partial list of those which were apparent to analysts during the trips. Many of the items were new to all analysts and several were confirmations of previous assumptions. All have shed light on the interpretation process and helped to explain many signature anomalies.

Drought conditions and crops under moisture stress cause many interpretation problems.

- The spotty stands and mottled signatures result in less differentiation between small grains and other crops.
- Small grains tend to reach the "turning" stage earlier than normal.

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- Depending on farmers personal preferences, some fields under moisture stress are plowed up and replaced with cash crops, others are left with the hope that moisture will be forthcoming. Additionally, portions of poor crop stands are plowed under and either replanted in a cash crop or left fallow until the following year.
- In dry years, there is a drastic difference between the signatures of irrigated and non-irrigated crops.
- Fields that are not fertilized during drought conditions develop better than those that are fertilized.

The variability of farming practices from one location to another significantly affect signatures.

- Small differences in planting dates cause major differences in signatures. This year, those fields that were planted in early (moist) spring developed better than those planted in late (drier) spring.
- Small grains that are planted under a wheat/fallow rotation system have stronger, healthier stands than those planted under a continuous small grain system.
- Insect and disease infected stands of small grains have highly variable signatures depending on the extent of the infestation, whether stands are chemically treated and when treatments are applied.
- Practices to prevent soil erosion include sod waterways planted in native grasses that meander through the agricultural fields.
- The amount and method of seeding small grains effect signatures.

- Signatures of alfalfa, corn, sorghum, native grasses, winter rye, barley, sugarbeets, oats and sweet clover were observed and compared to those of wheat.

Additional information beyond that of direct interpretive feedback was also derived from the Phase II field trips:

- Increased analyst confidence in the crop calendar updates resulted from comparing the Robertson stage indicated on the updates and the stages observed during the visits.
- The use of a professional photographer on four of the nine visits permitted the analysts to concentrate on their learning tasks and resulted in excellent photographic documentation.
- A problem with the Goddard Space Flight Center (GSFC) peak cluster algorithm was discovered when segment imagery for a perfectly clear day was not received at JSC.

3. RATIONALE

Field trips are required to give analysts a more realistic view of cropland and the diversity of agricultural practices. This view is essential in formulating a workable decision logic to be used during interpretations.

4. OBJECTIVE AND GOALS

The prime objective of the field trips is to extend LACIE training in an effort to gain a closer mental association between the image scene and the ground. These visits are considered as a "Lab" type extension of formal LACIE analyst training begun in 1974. In order to accomplish this objective the following goals have been established:

- Enhance analyst wheat recognition techniques by observation of both spring and winter wheat varieties in various phenological stages of development. This should greatly assist analysts in understanding variations in image signatures attributable to such stages of growth.
- Sharpen the individual analyst's interpretive confidence by (a) gaining a "feel" for image patterns and signatures' attributable to such non-biological factors as cropping practices, soils, topography, climate, etc.; (b) observe the widest possible range of "other agriculture" and "other small grain" types of crops. Both efforts will aid in reducing uncertainty and confusion by eliminating a measure of unfamiliarity.
- Continue visits to the existing U.S. "learning sites" and establish several new sites to broaden the analysts' exposure to more and different crops and cropping practices. Visits should coincide with Landsat II passes to provide both spaceborne and ground imagery for comparison. The "learning site files" will include all written field notes; ground, aircraft and spacecraft photographic data, maps, weather, and other pertinent data collected for each site.

5. RECOMMENDED LEARNING SITES

The following sites are recommended for visitation during LACIE Phase III: Williams County, North Dakota; Hand County, South Dakota; Finney County, Kansas; Whitman County, Washington; Bannock County, Idaho and Harris County, Texas. The first three are those sites visited during Phase II and have an acceptable level of diversity in cropping practices, confusion crops and topography to warrant revisits for Phase III. They also offer several advantages over other Intensive Study Sites; easy access to fields, assistance from local agricultural authorities, availability of "wall to wall" ground truth, and the farmers are accustomed to visitors. In addition, revisits will provide insight into year to year variability and a continuity of data for the learning site files.

The next two sites (Whitman, Washington and Bannock, Idaho) are not, in both instances, the highest wheat producing nor the most "typical" wheat growing regions. The areas are intended to exemplify selected problem areas for the analysts. The criteria used were (1) presence of interpretation problems, (2) occurrence of confusion crops, (3) soil variability, (4) topographic effects on agriculture, (5) various cropping practices, and (6) analogy to foreign agricultural areas. The last site (Harris County, Texas) is a local site designed to provide an inexpensive means of getting analysts in the field and expose them to wheat agriculture.

The proposed sites are discussed in more detail below:

Learning Site No. 1 - Spring Wheat Area

Location: Segment 1966, Williams County, North Dakota

Learning Site No. 1 offers an opportunity to visit an area largely devoted to the production of spring wheat varieties. Physical factors favoring such production also allow several confusion crop types to be grown. Of primary interest among these are several spring small grains, flaxseed, sugarbeets, sunflowers, rapeseed, and a variety of grasses used for grazing or hay.

Topography is mostly flat to gently rolling and fields tend to be large and regularly shaped. Strip cropping practices are present.

A good analogy exists between this spring wheat region of North Dakota and those of Soviet Siberia and some Canadian areas. The analogy encompasses both climate and agriculture as well as soils.

Learning Site No. 2 - Winter Wheat Area

Location: Segment 1988, Finney County, Kansas

This site is in a region of relatively high wheat yields. The major cropping practice for dry-land wheat is a wheat-fallow rotation system. The area has irrigated alfalfa, corn, and grain sorghum. It is typical of the Great Plains dry-land wheat farming. It was initially selected as a test site based on criteria such as high wheat yields, diverse cropping practices, confusion crops and topography.

Learning Site No. 3 - Mixed Wheat Area

Location: Segment 1687, Hand County, South Dakota

This site is in a region of both winter and spring growth. It offers relatively diverse topography, cropping practices and confusion crops. Wheat is followed by fallowing when dry-land farming is practiced, windrowing of wheat is common and irrigated alfalfa is present. Natural vegetation along stream beds and permanent pasture exist within the test site area. The major confusion crop is oats.

Learning Site No. 4 - Winter Wheat Area

Location: Segment 1973, Whitman County, Washington

Learning Site No. 4 is in a region with the highest wheat yields in the nation. Although primarily a winter wheat region, spring wheat is grown following winter kill or other poor growing conditions. Additionally, there is an abundance of confusion crops including spring barley and other small grains. Also of particular interest to the analyst are a variety of crops such as potatoes, hops, peas, lentils, and assorted truck crops.

The topography is hilly and undulating and is a chief contributor to the irregular ridgetop fields found here. Terracing may be practiced on steeper slopes and contour plowing is common practice here. Although a major wheat producing area, Learning Site No. 4 is not necessarily a "typical" wheat region.

Loess soils making high wheat production and a wide variety of crops possible also make this site analogous to some parts of foreign wheat regions. Contouring, terracing, and soils at this site are analogous to China's Yangtze Valley wheat areas. Soils are also similar to Argentine and Brazilian Pampas.

Learning Site No. 5 - Mixed Wheat

Location: Segment 1977, Bannock County, Idaho

This site contains significant proportions of both winter and spring wheat. Approximately 10% spring wheat, 17% winter wheat, and 2% other small grains were reported for the 1975-76 growing season. Other crops grown in the segment include alfalfa, oats, barley pasture, sugar beets, and potatoes. Field sizes vary from 4 acres to over 400 acres. Winter wheat, alfalfa and barley are all grown under both irrigated and dry-land conditions. Wheat is planted in strip and block fashion.

The site is analogous to the Western Black Soils Region of the Ukraine, USSR. Strong similarities exist between Bannock and the USSR Intensive Test Site (Kursk) in the areas of (1) mixed wheat; (2) confusion crops; (3) crop calendars; (4) climate; and, (5) topography.

Information important to LACIE Phase III objectives would be provided in the areas of small fields, low wheat production, cropping practices and confusion crops.

Learning Site No. 6

Location: Northwestern Harris County, Texas (Not a LACIE Sample Segment)

This area contains the closest wheat fields to the Johnson Space Center.

6. ANALYST PROCEDURES

The analyst teams, three analysts per team, will be responsible for accomplishing the following procedures. They will visit each site on dates corresponding to Landsat overpasses (See Appendix A for trip schedules). Each team will receive a pre-trip briefing to familiarize them with procedures and responsibilities relative to the field trips.

6.1 PRIOR TO TRAVEL

A. The team will sign out the "learning site" file and become thoroughly familiar with its contents. Fields to be visited and photographed will be selected and a detailed automobile route will be planned. The file contents to be used in planning and during the trip are as follows:

- Maps (1:250,000 and 1:24,000)
- Polaroids of Phase I and Phase II Landsat Imagery
- Aircraft Photography
- Ground Truth Field Overlay
- Other Ground Truth Data
- Crop Calendar
- Ancillary Summary
- Meteorological Data
- Notebook
- Previous Field Trip Data (if applicable)
- Frame Identification Slate

B. Verify that field contacts have been made (Field contacts would be established by a USDA representative at JSC. These contacts should be available to analysts to provide local expertise in agricultural practices and crop identifications.).

C. Coordinate with professional photographer who is to accompany the team.

D. All arrangements, reservations, etc. should be verified by the appropriate person(s).

6.2 IN-THE-FIELD

A. Verify field contact by phone and arrange an appointment.

B. Ask questions of field contact and locals. Document information in notebook.

C. Record crop type and photograph all fields visited (include fields visited on previous trips, if applicable).

D. Note unusual or unfamiliar cropping practices and confusion crops.

E. Note weather at time of Landsat overpass.

F. Make specific notes on appearance, height, row width, percent ground cover and general condition of wheat crop.

6.3 AFTER RETURN

Organize a one (1) to two (2) hour presentation illustrating what was learned on the field trip. The discussion should include a comparison between ground photographs and Landsat imagery emphasizing those factors affecting crop signatures. Any previously acquired information and slides

that would assist in demonstrating the temporal progression of crop signatures should be included in the presentations.

6.4 ARCHIVAL STORAGE AND RETRIEVAL

An additional responsibility of each team is to organize all the field trip data (photographic and written) into a suitable format for future use. These "learning site" files, documenting several years data, will be invaluable as training aids for new analysts and as reference materials for briefings and presentations. The detailed procedures for this task will be presented to each team in the pre-trip briefing.

APPENDIX A

LACIE PHASE III FIELD TRIP SCHEDULE

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LACIE PHASE III FIELD TRIP SCHEDULE

Williams County, North Dakota (Segment #1966)

Trip 1	May 24, 1977
Trip 2	June 29, 1977
Trip 3	July 17, 1977
Trip 4	August 4, 1977

Finney County, Kansas (Segment #1988)

Trip 1	November 3, 1976
Trip 2	May 2, 1977
Trip 3	June 7, 1977
Trip 4	June 25, 1977

Hand County, South Dakota (Segment #1687)

Trip 1	May 20, 1977
Trip 2	June 7, 1977
Trip 3	June 25, 1977
Trip 4	July 13, 1977

Whitman County, Washington (Segment #1973)

Trip 1	November 17, 1976
Trip 2	March 23, 1977
Trip 3	June 3, 1977
Trip 4	July 9, 1977

Bannock County, Idaho (Segment #1977)

Trip 1	May 11, 1977
Trip 2	June 16, 1977
Trip 3	July 22, 1977
Trip 4	August 9, 1977

Harris County, Texas

Approximately five trips dispersed throughout the wheat growing season.